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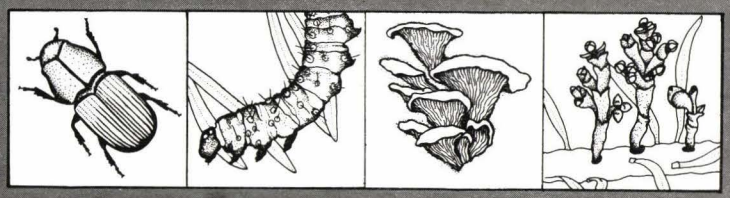

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RESULTS OF DAMAGE SURVEYS IN YOUNG NORTHERN REGION PLANTATIONS

By

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ROCKY MOUNTAIN STATION

INTRODUCTION

Plantation establishment is one of the most expensive silvicultural practices (Pfister 1976). Average costs of site preparation and planting in Region 1 were about $105 per acre in 1967, and rose to about $240 per acre in 1977. About 400 trees were planted per acre since the mid-1960's.

Seedling losses are greatest during the juvenile stages. Little was known about the causes (other than gophers) of seedling loss and frequency of occurrence in Region 1 (Wellner 1976), so we conducted damage surveys in young plantations in 1978 (Hard and Rice 1979) and 1979 to show where management changes might be desirable.

METHODS

We sampled primarily areas planted to Douglas-fir, ponderosa pine, lodgepole pine, western larch, and Engelmann spruce, and also a few plantations containing grand fir and western white pine.

Plantations established from 1974 through 1978 on the Lolo, Flathead, Clearwater, and Nezperce National Forests were sampled in 1978. Plantations established from 1964 to 1974 on the Bitterroot, Lolo, Flathead, Idaho Panhandle, and Clearwater National Forests were sampled in 1979.

We selected plantations from Ranger District compartment records and located them on aerial photographs, concentrating our survey on clearcut areas that had been planted. Selection was biased toward smaller plantations in order to sample a sizable number of plantations and variety of conditions. Average sample plantation size was 38 acres.

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One or more straight line transects intersecting maximum variation in topography, aspect, elevation, slope position, and proximity to adjacent stands were traversed in each sample plantation. Circular 1/100-acre sample plots were located at equidistant intervals on the transects. Each planted seedling in a plot was examined, and its species and condition were recorded.

Our purpose was to identify and record serious injuries to seedlings, not to catalog all causes. Gophers probably caused substantial seedling loss, but this survey was not designed to reveal most gopher damage because gophers often pull seedlings into their burrows. When the cause of injury could not be identified in the field, the affected seedling was uprooted and taken to the laboratory for diagnosis.

RESULTS

1978 Survey

We surveyed 104 plantations totaling 4,368 acres and examined 2,110 seedlings on 1,133 sample plots in 1978 (table 1). Average stocking on sample plots in these 1- to 5-year-old plantations was 186 planted seedlings per acre, about half of desired stocking.

One-half to three-quarters of all seedlings were undisturbed (table 2). For all species and all Forests combined, browsing by domestic stock or big game animals and defoliation by insects each accounted for 6 percent of all examined seedlings or 19 percent of all injured seedlings. Trampling by domestic stock or big game animals was the next most common cause of injury, accounting for 4 percent of all examined seedlings or 12 percent of all injured seedlings.

Defoliation, primarily by the western spruce budworm 2/ and the larch casebearer 3/, occurred on 20 percent of all grand fir seedlings, 15 percent of western larch seedlings, 7 percent of Douglas-fir seedlings, and 4 percent of Engelmann spruce seedlings (table 2). Defoliation in 1978 was more common on the Clearwater and Lolo Forests than on the Nezperce and Flathead Forests.

Frost damage was most prevalent on the Flathead Forest in 1978, but was found extensively in only two Douglas-fir and Engelmann spruce plantations that had been established in natural frost pockets.

2/ *Choristoneura occidentalis* Freeman.

3/ *Coleophora laricella* (Hubner).

The western pine-shoot borer 4/, a pine regeneration pest that mines the pith of terminal and lateral shoots, was found extensively in only one ponderosa pine plantation on the Nezperce Forest in 1978. This species can substantially reduce height growth, but it is a greater pest on older seedlings.

1979 Survey

We surveyed 132 plantations totaling 4,636 acres, and examined 2,266 seedlings on 2,325 sample plots in 1979 (table 3). Average stocking on sample plots in these 6- to 15-year-old plantations was 97 planted seedlings per acre. Actual stocking was higher on many plantations because additional seedlings had established naturally.

Although there were fewer seedlings per acre in the older plantations due to normal attrition, they generally had a higher percentage of undisturbed seedlings (table 4) compared to the younger plantations (table 2).

The major type of damage in 1979 for all species and all Forests combined was defoliation. Most was caused by western spruce budworm on Douglas-fir in the Bitterroot National Forest, and budworm and larch casebearer on larch in the Lolo National Forest (table 4).

Rodents, usually porcupines, caused the second most common form of damage, which was concentrated on ponderosa pine on the Darby Ranger District of the Bitterroot National Forest.

Winter drying of ponderosa pine needles; snow damage to ponderosa pine, lodgepole pine, and Douglas-fir; needle cast and frost damage of Douglas-fir and grand fir; and blister rust on white pine occurred at comparable frequencies. Winter drying and snow damage probably were greater than normal because the winter of 1978-79 was unusually severe in northern Idaho and western Montana. Blister rust was the only common cause of injury on white pine seedlings.

Terminals mined by the western pine-shoot borer were not encountered as often in 1979 as in 1978. However, in 1979 we did not survey plantations on the Nezperce National Forest, where we suspect that the shoot borer would have been more common in ponderosa pine plantations.

Damage by browsing and trampling of seedlings was much less in 1979 than in 1978, and it was often included in the miscellaneous category for some species and Forests (table 4). This reduction was expected because seedlings surveyed in 1979 were much larger than those surveyed in 1978 and

4/ Eucosma sonomana Kearfott.

could better sustain injury. However, in 1978 when 1- to 5-year-old plantations were surveyed, 31 percent of all injured seedlings were browsed or trampled. We consider this to be the most significant type of damage to young seedlings in our surveys, especially on the Nezperce National Forest where more than 50 percent of injured seedlings were trampled or browsed.

Obviously, plantations cannot be fenced to exclude big game, and costs of fencing new plantations to exclude cattle would be exorbitant. Research by Currie et al. (1978) on the effects of cattle grazing on young ponderosa pine in Colorado indicates that damage to young seedlings could be reduced. They recommend reducing grazing intensity to use 40 percent or less of principal bunchgrasses, keeping forested ranges in fair to good condition; and making adequate water available for livestock, which often browse pine seedlings for their moisture. Schubert (1974) concluded that light grazing during the wet summer season might cause little damage to seedlings at least 1 foot tall.

RECOMMENDATIONS

1. Surveys of the type described here are expensive and have low benefit-cost ratios, so future surveys should be confined to specific types of plantation damage, e.g., the western pine-shoot borer on the Nezperce National Forest or white pine blister rust on the Clearwater National Forest.

2. Consider limiting the number of cattle allowed to forage in new plantations for 3 to 5 years after plantation establishment.

3. When rangeland containing new plantations dries out in late summer, reduce cattle use further if water supplies for cattle are inadequate.

Table 1.--Summary of 1- to 5-year-old plantations in 1978 seedling damage survey

Forest	Ranger Districts	No. of plantations surveyed	Surveyed acreage	No. of 1/100-acre plots	No. of seedlings observed	Mean No. 1/ of seedlings per acre
Clearwater	Pierce	6	158	40	132	330
	Palouse	15	609	128	257	201
	Canyon 2/	2	71	32	6	19
	Lochsa	5	715	53	55	104
	Powell	11	221	91	161	177
	TOTAL	39	1,774	344	611	178
Nezperce	Salmon R./ Slate Ck.	5	76	37	40	108
	Clearwater	3	110	54	131	243
	Selway	9	268	110	233	212
	TOTAL	17	454	201	404	201
Lolo	Seeley Lk.	11	492	166	484	292
	Superior	12	399	151	138	91
	TOTAL	23	891	317	622	196
Flathead	Swan Lk.	15	940	194	307	158
	Hungry Horse	2	88	31	104	335
	Glacier View	2	54	21	31	148
	Tally Lk.	6	167	25	30	120
	TOTAL	25	1,249	271	472	174
	GRAND TOTAL	104	4,368	1,133	2,110	186

1/ Weighted means.

2/ A vehicle accident prevented the field crew from sampling this District more extensively.

Table 2.--Summary of the 1978 plantation seedling survey

CLEARWATER NATIONAL FOREST

NUMBER[1/] OF SEEDLINGS EXAMINED BY SPECIES AND CONDITIONS						
P. Pine-65	Lodge. Pine-77	D. Fir-157	W. Larch-60	G. Fir-49	W. W. Pine-92	Eng. Spruce-111
Undist. 49 (75)	Undist. 52 (68)	Undist. 107 (68)	Undist. 41 (68)	Undist. 26 (53)	Undist. 70 (76)	Undist. 88 (79)
Moist. stress 9 (14)	Trampled 12 (16)	Moist. stress 14 (9)	Trampled 2 (3)	Browsed 7 (14)	Trampled 14 (15)	Browsed 5 (5)
						Roots compacted 5 (5)
Misc. 7 (11)	Misc. 13 (17)	Trampled 4 (3)	Defoliated 11 (18)	Defoliated 8 (16)	Misc. 8 (9)	Misc. 13 (12)
		Browsed 4 (3)	Misc. 6 (10)	Misc. 8 (16)		
		Defoliated 6 (4)				
		Misc. 22 (14)				

NEZPERCE NATIONAL FOREST

NUMBER OF SEEDLINGS EXAMINED BY SPECIES AND CONDITIONS						
P. Pine-130	Lodge. Pine-15	D. Fir-204	W. Larch-0	G. Fir-15	W. W. Pine-0	Eng. Spruce-40
Undist. 81 (62)	Undist. 12 (80)	Undist. 151 (74)		Undist. 9 (60)		Undist. 23 (58)
Trampled 7 (5)	Trampled 1 (7)	Trampled 8 (4)		Trampled 1 (7)		Trampled 5 (13)
Terminal mined 16 (12)	Browsed 2 (13)	Browsed 28 (14)		Browsed 2 (13)		Browsed 5 (13)
Browsed 10 (8)		Misc. 17 (8)		Misc. 3 (20)		Defoliated 4 (10)
Misc. 16 (12)						Misc. 3 (8)

LOLO NATIONAL FOREST

NUMBER OF SEEDLINGS EXAMINED BY SPECIES AND CONDITIONS						
P. Pine-94	Lodge. Pine-32	D. Fir-257	W. Larch-180	G. Fir-10	W. W. Pine-0	Eng. Spruce-49
Undist. 78 (83)	Undist. 23 (72)	Undist. 167 (65)	Undist. 123 (68)	Undist. 1 (10)		Undist. 28 (57)
Trampled 9 (10)	Trampled 1 (3)	Trampled 9 (4)	Moist. stress 13 (7)	Defoliated 7 (70)		Trampled 2 (4)
Browsed 2 (2)	Misc. 8 (25)	Browsed 19 (7)	Trampled 2 (1)	Misc. 2 (20)		Defoliated 9 (18)
Misc. 5 (5)		Defoliated 30 (12)	Browsed 2 (1)			Misc. 10 (20)
		Aphids 7 (3)	Defoliated 24 (13)			
		Misc. 25 (10)	Misc. 16 (9)			

FLATHEAD NATIONAL FOREST

NUMBER OF SEEDLINGS EXAMINED BY SPECIES AND CONDITIONS						
P. Pine-77	Lodge. Pine-0	D. Fir-189	W. Larch-0	G. Fir-0	W. W. Pine-0	Eng. Spruce-205
Undist. 50 (65)		Undist. 127 (67)				Undist. 155 (76)
Browsed 13 (17)		Browsed 15 (8)				Browsed 4 (2)
Defoliated 5 (6)		Defoliated 21 (11)				Defoliated 4 (2)
Misc. 9 (12)		Frost damage 16 (8)				Frost dam. 24 (12)
		Misc. 10 (5)				Aphids 9 (4)
						Misc. 9 (4)

GRAND TOTAL ALL FORESTS

P. Pine-366	Lodge. Pine-124	D. Fir-807	W. Larch-240	G. Fir-74	W. W. Pine-92	Eng. Spruce-405	All Species
Undist. 258 (71)	Undist. 87 (70)	Undist. (66)	Undist. 164 (68)	Undist. 36 (49)	Undist 70 (76)	Undist. 294 (73)	(69)
Moist. stress 9 (2)		Moist. stress 14 (2)	Moist. stress 13 (5)				(2)
Trampled 16 (4)	Trampled 14 (11)	Trampled 21 (3)	Trampled 4 (2)	Trampled 1 (1)	Trampled 14 (15)	Trampled 7 (2)	(4)
Browsed 25 (7)	Browsed 2 (2)	Browsed 66 (8)	Browsed 2 (1)	Browsed 9 (12)		Browsed 14 (4)	(6)
Terminal mined 16 (4)							(1)
Defol. 5 (1)		Defol. 57 (7)	Defol. 35 (15)	Defol. 15 (20)		Defol. 17 (4)	(6)
		Aphids 7 (1)				Aphids 9 (2)	(1)
		Frost damage 16 (2)				Frost damage 24 (6)	(2)
						Roots compacted 5 (1)	(0)
Misc. 37 (10)	Misc. 21 (17)	Misc. 74 (9)	Misc. 22 (9)	Misc. 13 (18)	Misc. 8 (9)	Misc. 35 (9)	(10)

1/ Numbers in parentheses are percentages.

Table 3.--Summary of 6- to 15-year-old plantations in 1979 seedling damage survey

Forest	Ranger Districts	No. of plantations surveyed	Surveyed acreage	No. of 1/100-acre plots	No. of seedlings observed	Mean No. 1/ of seedlings per acre
Clearwater	Pierce	4	153	77	40	52
	Palouse	9	284	145	89	61
	Canyon	6	216	110	105	95
	Lochsa	6	211	103	31	30
	Powell	10	276	138	67	49
	TOTAL	35	1,140	573	332	58
Lolo	Ninemile	4	211	106	46	43
	Plains	6	217	109	61	56
	Seeley Lk.	9	254	129	57	44
	Superior	6	247	125	179	143
	TOTAL	25	929	469	343	73
Flathead	Bigfork	6	237	119	166	140
	Hungry Horse	3	85	41	87	212
	Tally Lk.	2	21	11	30	273
	TOTAL	11	343	171	283	166
Bitterroot	Stevensville	10	281	142	169	119
	Darby	10	346	173	195	113
	Sula	8	354	176	209	119
	TOTAL	28	981	491	573	117
Idaho Panhandle	Wallace	4	200	99	147	148
	Fernan	4	214	107	167	156
	St. Maries	6	247	124	145	117
	Sandpoint	5	202	100	115	115
	Bonners Ferry	10	256	129	126	98
	Priest Lk.	4	124	62	35	56
	TOTAL	33	1,243	621	735	118
	GRAND TOTAL	132	4,636	2,325	2,266	97

1/ Weighted means.

Table 4.—Summary of the 1979 plantation seedling survey

CLEARWATER NATIONAL FOREST

NUMBER 1/ OF SEEDLINGS EXAMINED BY SPECIES AND CONDITIONS

P. Pine-50		Lodge. Pine-15		D. Fir-107		W. Larch-9		G. Fir-89		W. W. Pine-39		Eng. Spruce-23	
Undist.	36 (72)	Undist.	11 (73)	Undist.	83 (78)	Undist.	4 (44)	Undist.	63 (71)	Undist.	6 (15)	Undist.	18 (78)
Rodent dam.	3 (6)	Snow dam.	2 (13)	Snow dam.	4 (4)	Defol.	5 (56)	Ndle. cast	6 (7)	Blstr. rst.	33 (85)	Aphids	5 (22)
Term. mined	3 (6)	Misc.	2 (13)	Frost dam.	11 (10)			Defol.	3 (3)				
Winter dry.	5 (10)			Misc.	9 (8)			Frost dam.	3 (3)				
Misc.	3 (6)							Misc.	14 (16)				

LOLO NATIONAL FOREST

NUMBER OF SEEDLINGS EXAMINED BY SPECIES AND CONDITIONS

P. Pine-138		Lodge. Pine-20		D. Fir-123		W. Larch-54		G. Fir-5		W. W. Pine-0	Eng. Spruce-3	
Undist.	122 (88)	Undist.	13 (65)	Undist.	93 (76)	Undist.	31 (57)	Undist.	3 (60)		Undist.	2 (67)
Winter dry.	9 (7)	Rodent dam.	3 (15)	Aphids	17 (14)	Defol.	19 (35)	Defol.	2 (40)		Term. mined	1 (33)
Trampled	2 (1)	Misc.	4 (20)	Frost dam.	7 (6)	Rodent dam.	4 (7)					
Misc.	5 (4)			Defol.	3 (2)							
				Misc.	3 (2)							

FLATHEAD NATIONAL FOREST

NUMBER OF SEEDLINGS EXAMINED BY SPECIES AND CONDITIONS

P. Pine-32		Lodge. Pine-0	D. Fir-155		W. Larch-96		G. Fir-0	W. W. Pine-0	Eng. Spruce-0
Undist.	31 (97)		Undist.	124 (80)	Undist.	89 (93)			
Misc.	1 (3)		Rodent dam.	10 (7)	Defol.	5 (5)			
			Frost dam.	7 (5)	Rodent dam.	2 (2)			
			Needle cast	9 (6)					
			Misc.	5 (3)					

BITTERROOT NATIONAL FOREST

NUMBER OF SEEDLINGS EXAMINED BY SPECIES AND CONDITIONS

P. Pine-366		Lodge. Pine-12		D. Fir-190		W. Larch-1		G. Fir-3		W. W. Pine-0	Eng. Spruce-1	
Undist.	248 (68)	Undist.	6 (50)	Undist.	92 (48)	Undist.	1(100)	Undist.	1 (33)		Undist.	1(100)
Rodent dam.	44 (12)	Rodent dam.	2 (17)	Defol.	50 (26)			Misc.	2 (67)			
Winter dry.	24 (7)	Misc.	4 (33)	Snow dam.	21 (11)							
Snow dam.	15 (4)			Frost dam.	7 (4)							
Ndles. mined	9 (3)			Term. mined	6 (3)							
Trampled	5 (1)			Misc.	14 (7)							
Term. mined	4 (1)											
Misc.	17 (5)											

IDAHO PANHANDLE NATIONAL FORESTS

NUMBER OF SEEDLINGS EXAMINED BY SPECIES AND CONDITIONS

P. Pine-8		Lodge. Pine-0	D. Fir-456		W. Larch-0	G. Fir-146		W. W. Pine-56		Eng. Spruce-69	
Undist.	8(100)		Undist.	391 (86)		Undist.	119 (82)	Undist.	47 (84)	Undist.	65 (94)
			Needle cast	15 (3)		Term. abort.	7 (5)	Blstr. rst.	4 (7)	Misc.	4 (6)
			Frost dam.	17 (4)		Ndle. rust	6 (4)	Misc.	5 (9)		
			Rodent dam.	10 (2)		Ndle. cast	5 (3)				
			Aphids	7 (1)		Frost dam.	3 (2)				
			Misc.	16 (4)		Misc.	6 (4)				

GRAND TOTAL ALL FORESTS

P. Pine-594		Lodge. Pine-47		D. Fir-1,031		W. Larch-160		G. Fir-243		W. W. Pine-95		Eng. Spruce-96		All-2,266
Undist.	445 (75)	Undist.	30 (64)	Undist.	783 (76)	Undist.	125 (78)	Undist.	186 (76)	Undist.	53 (56)	Undist.	86 (90)	(75)
Rodent dam.	47 (8)	Rodent dam.	5 (11)	Rodent dam.	20 (2)	Rodent dam.	6 (4)							(3)
Term. mined	7 (1)			Term. mined	6 (1)							Term. mined	1 (1)	(1)
Winter dry.	38 (6)													(2)
Trampled	7 (1)													(0.3)
Snow dam.	15 (3)	Snow dam.	2 (4)	Snow dam.	25 (2)									(2)
Ndles. mined	9 (2)													(0.4)
				Needle cast	24 (2)			Ndle. cast	11 (5)					(2)
				Frost dam.	49 (5)			Frost dam.	6 (3)					(2)
				Defol.	53 (5)	Defol.	29 (18)	Defol.	5 (2)					(4)
				Aphids	24 (2)							Aphids	5 (5)	(1)
								Ndle. rust	6 (3)					(0.1)
								Term. abort.	7 (3)					(0.1)
										Blstr. rst.	37 (39)			(2)
Misc.	26 (4)	Misc.	10 (21)	Misc.	47 (5)	Misc.	0 (0)	Misc.	22 (9)	Misc.	5 (5)	Misc.	4 (4)	(5)

1/ Numbers in parentheses are percentages.

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